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ORDER PICKING OPERATIONS IN WAREHOUSE SYSTEMS

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Abstract: Designing a warehouse and defining the type of appropriate warehouse equipment is a complex decision process, being a long-term strategic decision. Between the other functions like receiving and checking, storage, packing and shipping the orders, an important function in designing a warehouse is represented by the picking process. Developing an effective order picking operation and enhancing this in pick accuracy and speed, need to integrate new technologies combined with the adequate methods for picking the products.

1. INTRODUCTION

The classical warehouse becomes more and more a sophisticated place, determined by the large number of problems, types and demands of customer services. An important function in designing a warehouse is represented by the picking process, between the other functions like receiving and checking, storage, packing and shipping the orders.

2. KEY FACTORS IN WAREHOUSE DESIGN

Designing a warehouse and defining the type of appropriate warehouse equipment is a complex decision process, being a long-term strategic decision. In this process, collecting operation data is often the first step, database development being the most important part of any warehouse sizing and design process.

Warehouse activity profiling is the analysis of historical sales transaction data for the purposes of projecting warehouse activity and determining storage mode, physical layout, work flow processes, and labor and equipment requirements. Using this data, the company can examine the volume of receipts and shipments, the characteristics of those shipments, projecting inventory levels, plan the number of SKU along with the associated cube, velocity, seasonality, and inventory handling characteristics that are all critical to the design, inbound shipment characteristics, number of orders per day, lines per order, and pieces per line.

When designing a warehouse [1], the key factors need to be considered in determining the best solution between a manual or automated solution, are:

- ✓ The characteristics, size and weight of products;
- ✓ The product activity, the cubic velocity of a product;
- ✓ For storage systems, the choice is determined by the type of load units, range of products, quantity of loads for each SKU, movement rates of load units;
- ✓ In the case of picking methods it is necessary to take in consideration the total number of orders, total number of transactions, the characteristics of product being handled, picks per order, quantity per pick, picks per SKU, the number of SKUs, the value added processes and the type of pick;
- ✓ For selecting the material equipment, directly related to the layout and selected storage system, it has to consider factors such as product weight and volume, product fragility, productivity rates of different type of equipments and health and safety legislation;

- ✓ Outlines the key principles including optimization of space, flow of materials and equipment, types of storage i.e. bulk vs. small parts etc. and appropriate combinations of storage and handling equipment, different types of warehouses etc.;
- ✓ Establishing the best combination of handling and storage equipment;
- ✓ Outline of the key principles of warehouse automation and mechanization and key factors that influence the decision to automate a warehouse.

As general rules, it can be established two or three designing alternatives. It is recommended that these alternatives to include a simple conventional system, a system with medium mechanization level and a system with high mechanization, automation level and technology. The growth in mechanization degree is justified for the products with high speed. Invariably, a single designing approach is not applicable for the entire range of products.

To select the final option it is necessary to analyze also, the operation and investment costs, another costs involved, rate of investment recovery, the advantages and drawbacks of different alternatives, factors such as extension capacity, adaptability and simplicity of solutions.

The selected elements have different influences on the overall solution. More automation may reduce the labor cost, but increase the investment cost. More storage zones may improve the space utilization, but require more control. Zone picking may improve the productivity of the stock selectors, but require more planning and control of picking. For these reasons, it could be useful to develop an optimization model that would consider the trade-offs between all the available options and select the decisions leading to the best solution, according to the specified criterion.

3. ORDER PICKING OPERATIONS

Order picking processes, in classical, traditional variant, suppose the existence of some collectors, persons who pick out the articles from storage places, based on a picking list. The process of data introduction in an informatics system is manual, like the picking process of different articles. Automatic picking of products supposes a series of methods which offer picking tools, as well as data obtained based on developing informational and communication technologies.

To develop an effective order picking operation it is necessary to take in account the activity profiling, which consists in defining the product movement in terms of lines, cases or units picked. This process is essential in the present conditions, when the customers require smaller and more frequent orders.

Related to effectiveness of order picking, an important step is the selection of the most adequate picking equipment and technology. When it is involved in broken case picking, most commonly picking equipment could be static shelving, carton flow rack, vertical or horizontal carrousel, as well as mini load ASRS or automated conveyor and sorting systems [2]. Piece picking is used especially by e-commerce or mail catalogue companies and spare parts distributors.

Case picking operations know also, a large series of picking equipment, like pallet racking, configures in wide or narrow-aisle type, carrousels, automatic storage and retrieval systems.

For mail order and Internet ordering for books and media, a particular picking system can be used, known as forwarding picking. This consists in a group of picking stations or access point for pickers picking from walk through shelving. A conveyor system links all the

stations and the WMS controls the sequence that the product moves through the system. The effectiveness of picking can be improved using advanced picking technologies, including radio frequency terminal systems, wireless speech technology and pick/put-to-light systems.

In designing an order picking process it is useful to take in considerations an effective slotting strategy, calculating the number of facings or locations required for each product. Also, it can't be neglected how the products are stored. The layout and pick zone design should be integrated with the inbound and outbound flows of products.

The picking methods are established taking in account the characteristics of handled products, the number of orders and picks per orders, as well as the pick type. There is a large variety of methods in this field, from single order picking, zone and batch picking, to combinations of these and innovative methods, like cluster picking, wave picking, zone-batch-wave picking.

For example, batch picking is one of picking method based on the following principle: the collection of all order within a batch in a single pass of the order picking which uses a consolidated pick list, the operator picking one group of a group of orders at the same moment. This method has two alternatives:

- ✓ The picking of products into a common tote and further manual sorting and packing at a pack station;
- ✓ Collection in different totes of the line items for transport to an automatic sorter.

Batch picking is a method that can be used in a single pick zone or across multiple picking zones.

Cluster or Multi-order Picking is derived from discrete picking, but the difference is that the operator picks all the products for a group of orders. The collector picks the clustered line in different, distinct totes or cartons on the picking trolley. The advantage of this method is that when are reduced number of picks per order, it is possible to reduce significantly the travel time.

Zone-Batch-Wave Picking can be considered a combination between Zone-Batch-Picking method and Wave-Picking method. This method is based on the following principle: for each operator is assigned a zone and he collects all lines for the orders stocked in the assigned zone. In addition, he picks more than on order at a time. It is taking in consideration multiple scheduling periods per shift.

In designing an order picking system the importance of selecting the right material handling equipment cannot be overstated [3]. In this process, it has to take in account a series of factors direct related such as product weight and volume, the fragility of products, health and safety legislation, productivity rates. As consequence, this equipments for handling and transport of picked products, is specialized for small and low cube items, like trolleys and conveyors, and equipments for large and high cube items.

Key objectives in the process of design an order picking operation are represented by the increases in productivity, measured in pick rate, increasing in accuracy and reduction of cycle time.

Regarding the accuracy of this process, the development of technologies, like barcode or RFID scanners, pick-to-lights systems, coupled with training and monitoring through specialized systems has a positive impact on accuracy.

3. CONCLUSIONS

In designing a warehouse, between typical warehouse functions, an important role has the order picking process in improving the warehouse performance. Developing an effective order picking operation and enhancing this in pick accuracy and speed, need to integrate new technologies combined with the adequate methods for picking the products.

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